DOCUMENT RESUME

ED 133 026 JC 770 067

AUTHOR Belzer, Thomas J.
TITLE A Comparative Study of a Traditional Lecture Method and a Group-Paced, Multimedia, Non-Lecture Method used in Teaching College Biology.
PUB DATE [76]
NOTE 18p.

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS *Academic Achievement; Biology Instruction; College Science; Community Colleges; Comparative Analysis; Conventional Instruction; *Junior Colleges; *Lecture; *Multimedia Instruction; Persistence; Student Testing; Teaching Methods; *Testing; Tests

ABSTRACT

A study was conducted to test and compare the effects of a group-paced, multimedia, non-lecture method and a traditional lecture method of instruction in General Biology, and to determine if the type of evaluation used influenced a student's chances of successfully completing the course. Subjects were 308 students enrolling in General Biology during academic year 1975-76. Experimental classes (n=152) received instruction via audio-visual materials while the control classes (n=156) were taught by lecture. Students in both experimental and control classes were evaluated using the same test items; however, these questions were organized into three separate examinations during one semester and into ten quizzes during a second semester. Analysis of student achievement and attrition revealed: (1) the traditional method produced greater academic success than did the multimedia approach; (2) short quizzes for evaluation improved the student's chances of completing the course and earning the most points regardless of method of instruction; (3) short quizzes were preferred by students over block tests; and (4) overall, the lecture/quiz combination of instruction and evaluation produced the highest degree of academic success and the lowest rate of attrition. Tabular data are presented throughout the report. (JDS)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

ED133026

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

A COMPARATIVE STUDY OF A TRADITIONAL LECTURE METHOD AND A GROUP-PACED, MULTIMEDIA, NON-LECTURE METHOD USED IN TEACHING COLLEGE BIOLOGY

THOMAS J. BELZER, Ed.D.

SE 020 067

A COMPARATIVE STUDY OF A TRADITIONAL LECTURE METHOD AND A GROUP-PACED, MULTIMEDIA, NON-LECTURE METHOD USED IN TEACHING COLLEGE BIOLOGY

THOMAS J. BELZER
Pasadena City College
Pasadena, California

ABSTRACT

The purpose of this experiment was to test and compare the effects of a group-paced, multimedia, non-lecture method and a traditional lecture method of instruction in general biology at Pasadena City College. A second purpose of this study was to determine whether the type of evaluation used in the classroom significantly influences a student's chance of successfully completing a course in general biology.

The results of this study indicated that there is significant improvement in student achievement on tests when students are tested frequently with short quizzes regardless of the two methods of instruction used in this study. Students also express strong preference for this type of testing compared to longer examinations.

Additional results that were statistically significant indicated a tendency to prefer the lecture method of instruction regardless of the method of testing. The lecture method of instruction coupled with frequent quizzes produced higher mean scores on tests compared to the

other three combinations of instruction and testing (Lecture/Block-Testing, Multimedia/Quizzes, or Multimedia/Block-Testing).

The Lecture/Quiz combination of instruction and testing had the lowest percentage of attrition (11.3%). When this class was compared to the Multimedia/Block-Testing class (25% attrition), the difference in percentage of attrition was statistically significant. There were no significant differences in percentage of attrition between the other classes.

It is concluded from the results of testing and questionnaire findings that the lecture method of instruction coupled with frequent quizzes is the best combination of instruction and testing for the majority of students enrolled in General Biology 11A at Pasadena City College.

INTRODUCTION

The community college is that component of post secondary education which is most sensitive to the local community social structure and its divergent needs. The community college's open-door policy has invited an influx of "new" students into the classroom, many of whom exhibit a low basic-skills level in reading and mathematics. It behooves the community college, now more than ever before, to develop new instructional programs that are flexible enough to serve the community at large (Cross, 1971).

Current literature reveals that the American educational system is beginning to diversify from the lecture method in teaching. Colleges and universities are investigating numerous new programs in lieu of the lecture method. The most notable of these programs is the project in Audio-Tutorial (A-T) instruction developed by Samuel N. Postlethwait at Purdue University (1965, 1967). Numerous other projects in colleges are moving towards a diversification of the learning environment in an attempt to meet the needs of the individual student. These innovations are of particular importance to non-traditional students, who for a variety of reasons may not fit into the traditional patterns and sequences of education.

In 1967, the Commission on Undergraduate Education in the Biological Sicences (CUEBS) compiled guidelines for the content and organization of general biology courses for non-majors. These guidelines were valuable aids to biological education but failed to provide direction concerning the issue of instructional methodology. During this same period of time A-T instructional systems were beginning to be developed on many campuses and used experimentally with the hope of providing an instructional system capable of reaching all types of students. The outstanding advantage of the A-T method was the claim that this approach allowed for the individualization of instruction and self-paced learning.

Since 1970, the Life Science Department at Pasadena City College has been experimenting with a variety of new instructional designs in

its introductory biology courses. Most of these experiments have involved pilot programs to test the effectiveness of a new teaching strategy. The impetus for many of these experiments came from the frustrations teachers felt when trying to teach large, heterogeneous classes in the traditional lecture style. Academic achievement was declining, while the rate of attrition in the traditionally taught classes was increasing. Compounding the problem was the fact that several remedial science courses were dropped from the curriculum at about this same time. This meant that all students were enrolling in the same biology course for non-science majors, which brought about an even greater range in student ability and background in the classroom.

Most of the experimentation at Pasadena City College has been with A-T instructional systems. The results of these experiments have not been particularly helpful; attrition has not been significantly reduced, and student learning does not appear to have significantly increased.

Experiments with self-instructional techniques have surfaced the following problems related to the A-T teaching method:

1. While most students like the idea of self-instruction, many are not sufficiently mature to discipline themselves and accept responsibility for their own progress.
2. Self-paced students in biology courses do not perform better academically in their courses.

3. The audio-tutorial approach to instruction is impersonal, and there is a lack of social interaction.

4. Self-paced students in audio-tutorial classes have a history of higher attrition than students in traditionally taught classes (Belzer and Conti, 1973).

Another result of the experimentation with A-T instruction stimulated a search for new testing methods. Traditionally, biology students have been given three or four examinations during the semester and a final examination. After the General Biology 11A course was "modularized," it became more convenient to test students over each small unit of study. Giving frequent and shorter quizzes during the semester resulted in a significant improvement in grades and a remarkable reduction in attrition (Belzer, 1973).

Years of experience with the lecture method and more recent experimentation with the A-T methods indicate that an alternative teaching approach in the community college would be more effective than either method; such an assumption should be tested. The present study is an attempt to resolve problems inherent in both the lecture method and A-T method of instruction.

METHODS AND PROCEDURES

The subjects of this study were community college students enrolled in General Biology 11A, a life science course for non-majors at

Pasadena City College. The number of students starting and finishing the course is shown in Table 1.

Table 1

Sample Used in the Study

Group	Fall Semester (1975-1976)	Spring Semester (1976)
Control	76 students started 62 students finished	80 students started 71 students finished
Experimental	76 students started 57 students finished	76 students started 61 students finished

Both the experimental classes and the control classes were taught by the same instructor, the investigator in this study, during the Fall and Spring Semesters, 1975-1976. All four of these classes were listed in the schedule of classes bulletin along with the other General Biology 11A classes, which were taught by different instructors. Since only the students registering for General Biology 11A were used in this study, subjects could not be randomly selected. One class each semester was designated the experimental group (non-lecture, multimedia approach), and the other class each semester acted as the control group (lecture approach).

The experimental classes (multimedia) met as a group twice a week and became involved with audio-visual materials while in the classroom. This experience replaced the traditional lecture presentation.

The audio-visual materials used in the experimental classes had been previously used by students studying General Biology 11A independently. Independent study allowed students to pace themselves through the subject matter. In this study the instructor maintained control over the pace of the course by using the audio-visual materials in the classroom. The audio-visual materials used in this study consisted mainly of 16mm films, 8mm filmstrips, and cassette tapes, all of which were prepared commercially.

An additional dimension of this study involves an analysis of the relationship between an instructional method and an evaluation system. All four classes were given identical multiple-choice test questions covering the same instruction material. During one semester these questions were organized into three separate examinations. In the following semester the same questions were organized into ten quizzes. The four different combinations of instruction and testing are shown in Table 2.

Table 2

Instructional Method and Evaluation System

	Fall Semester (1975-1976)		Spring Semester (1976)	
Group	Type of Instruction	Type of Testing	Type of Instruction	Type of Testing
Control	Traditional	Block-Testing	Traditional	Quizzes
Experimental	Non-Traditional	Block-Testing	Non-Traditional	Quizzes

Since test results were used in part to evaluate the effectiveness of the instruction, the test results for all classes were compared. A comparison of block-testing and quizzes was made between semesters in both the experimental and control classes (if possible, the best combination of instructional method and evaluation system will be identified on the basis of this analysis).

A questionnaire (Educational Testing Service's "Student Instructional Report") was administered to all classes participating in the study in order to determine student reactions to the two methods of instruction and evaluation used during the two semesters.

ANALYSIS OF DATA AND FINDINGS

To assure the investigator that the various classes used in the study were comparable in ability at the beginning of the experiments, a thirty-question pre-test was given to the experimental and control groups during the first day of class. The thirty questions were selected at random from a pool of test questions from each of the ten major study units in the General Biology 11A course (three questions were selected from each unit).

Table 3 lists the mean, standard deviation, and z scores for the experimental and control groups on the thirty-question pre-tests.

Table 3

Pre-test Data For Fall And Spring Semesters, 1975-1976

Class	Number of Students	Mean Test Scores	Standard Deviation	Significance Of Differences
Experimental Fall Semester	74	13.31	3.17	z = 0.27 (not significant)
Control Fall Semester	73	13.47	3.42	
Experimental Spring Semester	70	11.70	3.73	z = 0.73 (not significant)
Control Spring Semester	83	12.13	3.46	

The information in Table 3 indicates that differences in mean scores on the pre-tests between the experimental and control groups in the Fall and Spring Semesters, 1975-1976, were not significant at the .05 level of confidence.

Significant differences were found between the lecture and multimedia classes when total points earned on the final examination (100) were added to the semester total (200). A maximum of 300 points could be earned in any class. Table 4 compares the mean score for both lecture classes with the mean score for both multimedia classes.

Table 4

Comparison Of Total Points Of
Lecture And Multimedia Classes

Class	Number Of Students	Mean Score	Standard Deviation	Significance Of Differences
Lecture	133	215.92	36.45	z = 9.69 (very significant)
Multimedia	118	208.54	35.94	

The lecture classes accumulated a significantly larger average number of points than the multimedia classes (215.92 to 208.54). This difference was significant at the .01 level of confidence.

Another dimension of this study is to compare the effect that different testing has on a student's ability to accumulate points. During the Fall Semester block tests were given to both classes and during the Spring Semester students were tested with frequent, short quizzes. Table 5 compares mean scores earned under the two types of testing.

Table 5

Comparison Of Block-Testing Versus Quizzes

Type of Testing	Number Of Students	Mean Score	Standard Deviation	Significance Of Differences
Block-Testing	119	209.79	35.13	z = 6.17 (very significant)
Quizzes	132	214.48	36.95	

The average number of points earned by students who were given frequent, short quizzes during the semester was significantly greater than the average number of points earned by students tested with longer examinations (214.48 to 209.79). This difference is very significant beyond the .01 level of confidence.

A final comparison of the four classes with four different combinations of testing and instruction is made in Table 6. This comparison is based on total points accumulated during the semester (including the final examination).

Table 6

Class Rank Based On Total Points

Rank	Class	Number Of Students	Total Points	Mean Score
#1	Lecture/Quiz	71	15,421	217.20
#2	Lecture/Block-Testing	62	13,297	214.47
#3	Multimedia/Quiz	61	12,917	211.75
#4	Multimedia/Block-Testing	57	11,691	205.10

The Lecture/Quiz class ranks highest with a mean score of 217.20 points out of 300 points possible (this includes the final examination). In Table 7 a comparison is made between the Lecture/Quiz class and the three other classes to determine if the difference in class rank is significant.

Table 7

Comparison Of Lecture/Quiz Class With Other Three Classes

Class	Number Of Students	Mean Score	Standard Deviation	Significance Of Differences
Lecture/Quiz	71	217.20	37.73	z = 2.63 (very significant)
Lecture/Block-Testing	62	214.47	34.88	
Lecture/Quiz	71	217.20	37.73	z = 5.09 (very significant)
Multimedia/Quiz	61	211.75	36.18	
Lecture/Quiz	71	217.20	37.73	z = 11.09 (very significant)
Multimedia/Block-Testing	57	205.11	35.73	

The Lecture/Quiz class was clearly the best combination of instruction and testing when the average number of points earned by this class is compared to the other three classes. The differences between these classes were all significant at the .01 level of confidence.

The percentages of attrition for the classes taught in the Fall and Spring Semester, 1975-1976, are presented in Table 8.

Table 8

Comparison Of Attrition
Between The Four Different Classes

Class	Students Starting Class	Withdrawals	Percentage Of Attrition
Lecture/ Quizzes	80	9	11.3
Lecture/ Block-Testing	76	14	18.4
Multimedia/ Quizzes	76	15	19.7
Multimedia/ Block Testing	76	19	25.0

The Lecture/Quiz class had the lowest percentage of attrition. When this class is compared to the other three classes, the difference in percentage of attrition between the Lecture/Quiz and the Multimedia/ Block-Testing classes is significant at the .05 level of confidence ($x^2 = 4.17$). There are no significant differences between the other classes.

Response To The Questionnaire

A standardized questionnaire (Educational Testing Service's Student Instructional Report) was administered to the lecture classes and to the multimedia classes at the end of the semester. This questionnaire gave the students an opportunity to express anonymously their views of the course and the way it had been taught. The 39

questions were grouped into three categories:

Section I - Twenty questions primarily concerned with teaching techniques and instructor characteristics.

Section II - Eleven questions concerning student characteristics (grade-point average, sex, class level, and reasons for selecting the course).

Section III - Eight questions involving the organization of the course and use of course materials.

The significance of the differences in responses to these questions was determined by chi-square. There were no significant differences in student responses when the lecture classes were compared to the multimedia classes.

Conclusions

The first part of the conclusions relates to the questions: Can individualized instructional materials be used successfully with large groups of students in the classroom? On the basis of the findings in this study it appears that the multimedia approach used in group instruction does not produce the same degree of academic success as traditional lecture instruction in General Biology 11A.

A second question related to this study was: What is the difference in student achievement when different forms of evaluation, i.e., short quizzes versus block-testing, are used in the classroom? The findings from this study indicate that the short quizzes improve a student's chance of completing the course and earning the most points.

Students in both the multimedia and lecture classes preferred this type of evaluation over longer examinations covering several units of instruction at one time.

The final question was: How is a student's evaluation of instruction influenced by the type of instructional methods employed in the class? On the basis of the questionnaire findings there were no significant differences in student evaluation of instruction regardless of the type of instruction.

The final conclusions reached on the basis of test results indicates the Lecture/Quiz combination of instruction and testing produces the highest degree of achievement. There are also indications that this combination of instruction and testing can best reduce the percentage of attrition in General Biology 11A classes.

REFERENCES

Bell, Paul A. "An Exploration of Alternative Methods For Teaching Large Sections of General Biology," 1970. (ERIC ED 307 356).

Belzer, Thomas J. "A Comparison of Two Methods of Evaluation on Attrition and Final Grades in General Biology," Practicum presented to Nova University, 1973. (ERIC ED 101 816).

Belzer, Thomas J., and Michael R. Conti. "A Comparison of Grades Achieved, Attrition Rates, and Teacher Evaluation in a Traditional Biology Course Versus a Non-Traditional, Audio-Tutorial Biology Course," Practicum presented to Nova University, 1973. (ERIC ED 094 810).

Centra, John A. "Strategies For Improving College Teaching," American Association For Higher Education, Dec., 1972.

Cross, K. Patricia. "New Students of the 70's," The Research Reporter, Vol. 1 (4), 1971.

Feldhusen, J. F. "Student Perceptions Of Frequent Quizzes and Post Mortem Discussions Of Tests," Journal Of Educational Measurement, 1, 1964.

Geisert, Paul. "Individualization of Student Rate, Goals, and Instructional Methods For an Introductory Biology Program," Journal Of College Science Teaching, November, 1974.

Peck, David, and Sam Brown. "Programmed Instruction, Group-Pacing Versus Self-Pacing: A Teaching Effectiveness and Cost Comparison Study," AIBS Education Review, Vol. 4, No. 1, March, 1975.

Postelthwait, Samuel N. "Audio-Tutorial: A Practical Solution For Independent Study," Medical And Biological Illustration, Vol. 15, No. 3, July, 1965.

UNIVERSITY OF CALIF.
LOS ANGELES

FEB 18 1977

CLEARINGHOUSE FOR
JUNIOR COLLEGES